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Clairton Works
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September 30, 1994

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SUBJECT: U. S. Steel Clairton Works
Title 25 Pennsylvania Code Section 123.51 - NO_x CEM

Gentlemen:

Pursuant to Title 25 PA Code Section 123.51 and the Notice of Violation (NOV) issued by the U. S. EPA U. S. Steel has implemented the process for purchase and installation of NOx Continuous Emissions Monitors (CEMs). This Phase I submittal has been prepared in accordance with the requirements specified in the DER Continuous Source Monitoring Manual.

This Phase I submittal addresses the CEM monitors to be installed on the following Clairton emission sources: Boiler Nos. 1 and 2; and Battery "B". Per out recent telephone conversations, the Phase I proposal for the three Edgar Thomson Works sources is being submitted separately,

Please contact me (412-433-5918) or Bill Graeser at (412) 233-1467 should you have any questions on the enclosed. We would appreciate your timely review of this submittal.

Sincerely,

Jeffrey C. Fadale for
Lorraine Guevara

Attachment
JCF/ld-94338

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CONTINUOUS EMISSIONS NO_x MONITORING PLAN

for

U. S. Steel Corporation

located in

Clairton, PA 15025

Facility I. D.: USS Clairton Works

Stack ID: B Battery

Project 1901

September 30, 1994

Written by:

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1. Introduction

This document contains quality assurance and quality control information for continuous emissions monitoring as required by the US EPA and Pennsylvania Department of Environmental Resources (DER), pursuant to promulgation of Title 24 Pennsylvania Code Chapter Section 123.51, for B Battery at:

U. S. Steel Corporation
Clairton, PA 15025

This monitoring plan contains procedures that will assure that high quality environmental measurements are collected by the CEMS. Quality assurance assesses the data adequacy. Quality control are the steps taken to assure the data is adequate. This document outlines specific checks and their frequencies in order to assess and report the accuracy of environmental measurements. The document is written to conform to the US EPA and Pennsylvania Department of Environmental Resources (DER) guidelines and the QA provisions found in US EPA 40CFR60 and PADER regulations.

This quality assurance plan will develop CEMS data that is acceptable to US EPA and Pennsylvania Department of Environmental Resources (DER).

In general this plan includes:

- Daily checks of the CEMS operational status and calibration accuracy.
- Continuous evaluation of quality assurance activities as well as preventive maintenance procedures.
- Corrective action procedures for use when the performance of the CEMS is unacceptable.

The data and results gained from the successful quality assurance plan provide technical personnel with the ability to track trends in CEMS performance, and provide useful documentation for routine operation of the CEMS, repair and maintenance of the CEMS, and preparation of reports.

1.1 Executive Overview

The CEMS described by this Monitoring Plan consists of several major subassemblies which will be used to monitor the NO_x emissions for the Clairton Works B Battery.

These subassemblies are:

Subassembly: Sample Conditioner Cabinet

The Sample Conditioning System is contained in a open frame chassis within the CEMS cabinet.

The gas Analyzers, Sample Conditioner, Calibration Unit and Remote Data Acquisition PLC are mounted within this cabinet.

Subassembly: Sample probe and sample line

The sample probe is mounted into the stack through a port in the stack wall, and is attached to a flange on the port. Its position is in compliance with 40CFR60. The stack probe is connected to the sample conditioning and calibration control units via an insulated, electrically heated tubing bundle which carries calibration gas, and the electricity required for the probe heater, to the probe. This sample line is attached with clamps to the supporting members of the stack so that it is oriented in a continual downward direction, assuring that there are no low spots in which condensate may collect, blocking the flow. The temperature of the sample flowing through this sample line is maintained electrically at 250 degrees F., so that no condensate is formed. The control of this temperature is managed by a temperature controller and relay located in the Analyzer Cabinet.

Subassembly: Sample Conditioning System

The Sample Conditioning System is contained in the Analyzer Cabinet and is designed to remove the particulate matter and moisture in the sample, prior to introducing it to the gas analyzers. It also assures that there is sufficient sample flow to the analyzers so that there is no risk of sample starvation.

Subassembly: Stack Gas Analyzer

The Stack Gas Analyzer is located in the Rittal cabinet, which contains all of the gas analyzers mentioned in this protocol.

The gas analyzers are housed within the Analyzer Cabinet, and are slide mounted for easy access in the case of maintenance. The gas analyzers receive sample gas from the sample conditioning system, and exhausts unused or excess sample through an exhaust port.

Subassembly: Calibration Control Unit

The Calibration Control Unit, also contained in the Analyzer Cabinet, provides for the introduction of a sequence of zero and span reference gases to the sample probe. These gases are used to calibrate the analyzers. This unit opens and closes a series of solenoid valves for measured intervals to allow a regulated flow of these reference gases. The reference gases are contained in cylinders equipped with two stage regulators, and are installed a short distance from the Stack Gas cabinet, through which

is fed the reference gases using tubing manufactured with teflon, PVDF (Kynar) and/or Stainless Steel.

The Calibration Control Unit is part of the more general purpose data collection and control unit later defined as the Remote Data Collection Node (RDCN).

Subassembly: Data Acquisition System (DAS)

The Data Acquisition System (DAS) consists of a Allen Bradley PLC RDCN, and a Data Acquisition Computer (DAC). The RDCN is mounted in the Analyzer Cabinet and receives analog electrical signals from the various pieces of equipment. These analog signals may be either current or voltage levels which are proportional to the value of a monitored parameter. The RDCN converts the input into the appropriate engineering units. The RDCN also tests these values for alarm conditions, performs further mathematical corrections on them, and finally transmits the data, at high speed, to the DAS for recording, display and printing. The DAS, which may be located up to 1000 feet from the Analyzer Cabinet, also generates the mandated reports.

The DAS component of the proposed CEMS will display and record many I/O points in real time. A list of these points is found in the project description section.

The CEMS is designed to provide valid data capture in excess of 90.0%, excluding daily calibrations, based on source quarterly calendar operation.

2. Background Information

2.1. Project Name

Quality Control/Quality Assurance Project Plan for Continuous Emissions Monitoring on B-Battery at U. S. Steel Corp., in Clairton, PA.

2.2. Project Design Criteria

This system is designed to comply with the CEM requirements for one or more of the following governing agencies: US EPA and Pennsylvania Department of Environmental Resources (PADER).

2.3. Project Description

The monitoring plan outlines the CEMS requirements for B-Battery operated by U. S. Steel Corp. in Clairton, PA.

Waste heat generated by the battery heating process flows down through the battery regenerators, gas-offside, to the battery waste-heat canals. The canals connect at the base of the stack and as the heat rises through the stack, it creates a vacuum, pulling oir into the battery for combustion, and drawing off the waste heat.

3. Data Acquisition System (DAS)

The manufacturer of the recording or data acquisition device is Enertec Inc. The DAS node is referred to as the SNIFFER. SNIFFER consists of two hardware components. A Data Acquisition Computer (DAC) and a Remote Data Collection Node (RDCN). The part connected to the analyzer is the RDCN.

3.1. Central Processing Unit (CPU)

The SNIFFER data acquisition unit is designed around a central processing unit.

The CPU consists of:

- Manufacturer: Micronics Computer Corp.
- Description: IBM Compatible
- Processor: 80486
- Speed: 50 Mhz
- RAM: 16-Meg ram, 64K cache
- Floppy: 1.44 Meg 3.5 inch floppy disk
- Hard disk: 200 Mega bytes
- Monitor: SVGA color monitor
- Operating System: SCO UNIX-IV
- Keyboard: 101 style keyboard
- Printer(s): Panasonic dot matrix
- Modem(s): 9600 Baud modem
- Tape: Jumbo 250 Megabyte

Data collection is accomplished via a network of industrial input and output modules connected to a high speed local area network using the RS-422 protocol. The data collection devices are located in an analyzer rack located close to the sample extraction point.

The DAS computer system is in a stand-alone computer system which must be housed in a more suitable environment such as a control room and must be protected by an electrical surge suppressor and/or an uninterruptable power source (UPS).

This system has a tape drive capable of storing and retrieving monitored I/O point data. The backup process is manually initiated by the operator using the "Backup Data" command found in the SNIFFER menu. This command allows the operator to select a start and stop date for the back up, as well as the channels which are to be saved and/or restored.

The modem is included for software support and system upgrade by an Enertec, Inc. engineer only. This allows quicker response to problems that may arise in the continuous emissions monitoring system.

3.2. Remote Data Collection Node (RDCN)

The Remote Data Collection Node (RDCN) is built around a series of intelligent input and output modules manufactured by Allen Bradley. These modules are packaged for harsh industrial environments and communicate with the IBM Compatible (DAC) using the high speed industry standard RS-422. The RS-422 communications protocol ensures a reliable message delivery system with inherent integrity checks on all messages. The RDCN is mounted inside of the gas analyzer cabinet for ease of connection and added protection.

Included in a typical system are analog-to-digital convertors which take signals from the analyzers, and convert the 4-20 milli-amp signal into digital values. These digitized values are converted into engineering units within the RDCN.

The digital input points within the RDCN are used to detect the presence of conditions such as "calibration in progress" or "analyzer fault". The input points can also be used to detect conditions such as "Process On/Off", "Process Start up" or "Process Shutdown".

The use of the AB PLC 5/20 not only simplifies the design of the system and its maintenance, but also increases the reliability of the entire system.

The RDCN can run in a stand-alone mode (i.e. not connected to the data acquisition computer). Even if the data acquisition computer is down the RDCN continues to calibrate all analyzers. In addition the RDCN has battery backed up memory. Data for each channel can be stored in the battery backed up memory of the RDCN. This ensures that if the data acquisition computer is down for any reason that no data is lost. When the data acquisition computer comes back up, the software "catches up" by automatically retrieving any available data from the RDCN. The data in the RDCN is stored on a "first in first out" (FIFO) basis.

3.3. Remote Data Collection Node (RDCN) spare parts

The following spare parts are recommended for the Allen Bradley, AB PLC 5/20.

Qty	Description
1-	Allen Bradley PLC 5/20 CPU
1-	PLC 5/20 DCM
1-	24 VDC Digital input module
1-	4-20mA input module
1-	Relay output module

4. Sample transport system for analyzers

This section describes the sampling procedure, the method in which the sample is collected, processed and analyzed. The sample transport uses the extractive method (no dilution).

The sample transport consists of the "Sample Probe", "Sample line" and the "Sample Conditioning Unit".

The sample probe is inserted at the sample point. The sample gas is then drawn through the probe into the sample line which is heated in order to prevent condensation of moisture. The sampling pump, located in the sample conditioning unit, draws the sample from the probe into analyzer cabinet where the sample has moisture and particulate matter removed prior to going to the analyzers.

4.1. Sample Probe

The probe is Hastel log and is capable of withstanding up to 400 degrees F. The sample probe is installed directly in the exhaust stack and incorporates an easy to change cartridge type primary filter. The probe body is mounted on a 2 inch ASA 150 lb flange which is mounted to the stack on a pipe such that a section of pipe is exposed beyond the outer shell of the stack for cooling purposes. The probe has an extraction tube whose length is cut so that the tip extends at least one (1) meter form the stack wall as per 40CFR-60 Appendix B. Spec. 2, Section 3.1.2.

In order to prevent condensation of moisture, the Primary Filter is heated to a temperature of about 110 degrees C by a 50 VA electric heater in the sample probe assembly. After passing through the primary filter the sample gas passes along a sample line.

4.2. Sample Line

The sample line is a two inch bundle which contains two teflon tubes which are wrapped with a heater strip and insulation. The complete bundle is then covered with a PVC outer shell.

There is a thermocouple inside the bundle which is used along with the heat strip to maintain the sample at approximately 250° F. A temperature controller is used to regulate the sample line temperature.

The 3/8 inch tube is connected from the sample probe to the sample conditioning unit and is used to convey the sample gases. The 1/4 inch tube is used to take calibration gases from the calibration unit up to the probe where it is injected into sample tube at the sample probe location.

The calibration gas flow is set to insure that calibration gas completely floods the sample line. These gases are then drawn through the complete sample conditioning system and to the analyzers.

4.3. Sample Conditioning Unit

The sample conditioning unit is located in the analyzer cabinet. The sample conditioning unit

uses a unique rapid dehumidification mechanism to remove water from the sample. The sample gas then passes through the sample handling system which consists of a mist catcher, particulate filter, flow selector valves, a pump, a dehumidifier, a pressure relief water trap and then on to the analyzers. When the sample gas enters the analyzer system the temperature must be lower than 40 degrees C.

All surfaces which come in contact with the sample gas are Teflon, poly vinyl chloride or 304 stainless steel. The sample handling system samples the stack gas and supplies a constant volume of clean sample to the analyzers. It also is designed to automatically discharge the condensate.

4.4. Sample Conditioning Unit manufacturer and model number

Manufacturer:	BEI Baldwin Environmental, Inc.
Model number:	5210 Sample Gas Chiller

4.5. Principle of operation of analyzer

The sample is drawn through two chambers. The first chamber is attached to a fan cooled heat sink which cools the sample down near the ambient temperature. This chamber collects the condensate and pumps it to the CEM system drain. The sample is then drawn through an identical chamber which is chilled using a peltier electronic chiller. The temperature of this chamber is electrically controlled to stay below 4° C, (39.2° F).

There are two digital outputs on this sample conditioner. The first indicates when the chiller is $<10°$ C. and the second indicates if any moisture (slip) has condensed down stream from the chiller.

The CEM system monitors both of these through digital inputs.

4.6. Sample conditioning spare parts

The following spare parts are stocked with the unit (one year supply).

1. Teflon filter element 1 pieces

4.7. Routine maintenance

Anytime maintenance is performed, the maintenance switch on the analyzer cabinet should be depressed. This action tags the data with the maintenance status bit which can be used to identify and/or explain data fluctuations on any reports issued by SNIFFER.

All maintenance must be scheduled as not to conflict with the predetermined calibration time.

4.8. Routine maintenance for the sample probe

The probe has no moving parts. It does however have a coarse particulate filter and an electric heater.

The electric heater can be checked by using a clamp on AC amp meter to detect current on the power wires going from the analyzer cabinet into the sample line up to the probe.

The filter is manually checked as part of the maintenance procedures defined below.

4.9. Routine maintenance for the sample line

The sample line requires no maintenance. However, it is advisable to periodically inspect the sample line visually to detect any damage or wear due to rubbing, vibration, physical damage etc.

If the sample line is installed properly there should be no stress points which could cause the tubing to become kinked or blocked in any manor.

4.10. Manual Preventative Maintenance

Log books are maintained at the analyzer cabinet which houses the analyzers and the sample conditioning unit. The appropriate log books are filled out each time the technician services the CEMS. If sample flow rates change by a large amount over time, it may indicate that the probe is plugged. If the vacuum pump differentials change dramatically, it would indicate excess moisture in the system. These are the types of conditions that the technician looks for each time he visits the analyzer. Close supervision of the system and spare parts (particularly filters) are integral parts of the preventative maintenance program.

More detailed information on operation and maintenance procedures are contained in the BEI Baldwin Environmental, Inc. 5210 Sample Gas Chiller Operations and Maintenance manual.

4.10.0.1. Daily Preventative Maintenance

The operator will depress the system maintenance switch.

The operator will check the flow and pressure of the sample conditioning unit to detect any changes from the prescribed operational settings.

4.10.0.2. Monthly Preventive Maintenance

Once a month the primary filter element at the stack probe is removed and checked to see if it is clogged or soiled. If it is soiled it is replaced. The seal packing is also removed and cleaned. If the O-ring is damaged then it is replaced.

4.10.0.3. Quarterly Preventive Maintenance

Once a quarter the sample probe is checked and cleaned. Quarterly the flow rate is checked to ensure enough flow is taking place. If the flow is low and there are no problems in the probe or sample line then the pump is replaced. The air filter is checked once each quarter. If the air filter is soiled it is replaced.

4.10.0.4. Yearly Preventative Maintenance

Once a year the sample line is inspected for clogging or soiling. The activated charcoal scrubber should be replaced once a year.

4.10.1. Project responsibility

Specific individuals are responsible for insuring the system complies with the operational protocol.

See the attached Appendix A of this document.

5. Oxygen Analyzer

5.1. Analyzer manufacturer and model number

Manufacturer:	Servomex Co., Inc.
Model number:	1400B

5.2. Principle of operation of analyzer

The oxygen analyzer is based on the paramagnetic method. This method uses a dumb-bell mounted on a torque suspension in a strong, non-linear magnetic field. The higher the concentration of oxygen, the more the dumb-bell is deflected from its' rest position. This deflection is detected by an optical system and twin photo-cells connected to an amplifier. The dumb-bell is surrounded by a coil of wire. A current is passed through this wire to drive the dumb-bell to its' zero position. The current required to maintain the dumb-bell's zero position is proportional to the oxygen concentration in the cell.

5.3. Range of operation for the analyzer

The oxygen analyzer has the following specification:

* Range:	0-25%
* Zero Drift:	(negligible as per manufacturer)
* Span Drift:	(negligible as per manufacturer)
* Repeatability:	± 1 percent of full scale per week

5.4. Calibration standards for the analyzer

The calibration gases are to be purchased from a specialty gas supplier. The oxygen zero gas is the CO span gas, which contains 0% O2. The oxygen span gas is 22.0% Oxygen in Nitrogen base EPA Protocol 1 or certified gas.

All gases used for calibration must be certified as NBS Protocol, EPA Protocol 1 or Certified gas.

This calibration is performed in conformance to 40CFR60 Appendix B, Performance Specification 3, and 40CFR60 Appendix F.

5.5. Calibration schedule for the analyzer

The analyzer is automatically calibrated once a day. The calibration is initiated by the PLC (RDCN) and is controlled by the SNIFFER system.

At a preset time each day the PLC performs a series of steps to open and close solenoid valves which control the calibration gases. All of the calibration gases are introduced at the probe on the stack.

For specific information on the calibration sequence for this CEMS please refer to the "CEMS calibration" section in this protocol.

5.6. Routine maintenance for the analyzer

Preventative maintenance procedures followed on a routine basis to periodically check the CEMS should catch any problems before any data loss occurs.

Most routine maintenance work can be carried out from the front of the analyzer cabinet. This makes the routine maintenance procedures much easier.

5.6.1. Preventative Maintenance by computer

The computer software in the data acquisition system checks the following points on a routine basis.

- The computer monitors the fault indicator on the oxygen analyzer.
- The computer monitors the calibration drift on the oxygen analyzer.

If any of the points fall outside of the normal range, an error signal is generated and the operator is notified.

5.6.2. Manual Preventative Maintenance

Log books are maintained at the analyzer cabinet which houses the analyzers and the Allen Bradley PLC (RDCN). The appropriate log books are filled out each time the technicians services the CEMS. If sample flow rates change by a large amount over time, it may indicate that the probe is plugged. If the vacuum pump differentials change dramatically, it would indicate excess moisture in the system. These are the types of conditions that the technician looks for each time they visit the analyzer.

More detailed information on operation and maintenance procedures are contained in the Servomex Co., Inc. 1400B Operations and Maintenance manual.

5.6.2.1. Daily Preventative Maintenance

The Allen Bradley PLC (RDCN) checks and records the zero and the span of the analyzer each day.

There is no additional daily maintenance for this analyzer.

5.6.2.2. Monthly Preventive Maintenance

The only item in need of monthly maintenance is an in-line sample filter located on the back of the analyzer. Each month this filter should be visually examined to determine if particulate matter is beginning to restrict the flow. If particular matter is visible, the filter should be replaced.

5.6.2.3. Quarterly PM

In three out of four quarters, this analyzer will have a cylinder gas audit (CGA) performed on it. This audit is performed in conformance with 40CFR60 Appendix F section 5.1 and all applicable sub paragraphs.

5.6.2.4. Yearly Preventative Maintenance

Once a year a relative accuracy test audit (RATA) or relative accuracy audit (RAA) is performed.

This audit is performed in conformance to 40CFR60 Appendix F.

5.6.3. Project responsibility

Specific individuals are responsible for insuring the system complies with the operational protocol.

See Appendix A of this document.

5.6.4. Recommended Spare Parts

None for the oxygen analyzer. Most of the spare parts are listed under the sample conditioning unit.

5.7. Oxygen reports

5.7.1. Daily oxygen reports

Two styles of daily reports for oxygen are available for printing. The first report prints the average value for every minute in any calendar day. The second report prints a line graph of one minute values. The first report includes other status information such as fault conditions and calibration status. A sample of each report is included in Appendix C of this document.

5.7.2. Quarterly oxygen report

A sample quarterly oxygen report as required by the US EPA and Pennsylvania Department of Environmental Resources (DER), is included in Appendix C of this document.

5.8. Parameters monitored by SNIFFER.

Allen Bradley PLC (RDCN) monitors a signal from the oxygen analyzer corresponding to percent oxygen. It also monitors two digital lines which indicate when the oxygen analyzer is performing calibration and if it has failed its calibration. The final signal being monitored by the remote data collection unit is an analyzer fault line. The SNIFFER data acquisition unit saves this data to the hard disk once each minute:

- Oxygen percent
- Analyzer calibration status

5.9. Rate of data collection for analyzer

The SNIFFER takes a reading from the oxygen analyzer about once every second. Once every ten seconds the SNIFFER requests the latest data from the remote data collection unit. These readings are averaged together in the data acquisition system to construct a one minute average. The actual analyzer reading and analyzer status information (calibration and fault status) are transmitted from the remote data collection unit to the data acquisition computer.